

CONSTRUCTION TECHNOLOGY: HVAC I

Construction Technology: HVAC I includes classroom and laboratory experiences focused on heat generation, ventilation, and cooling/refrigeration systems. This course introduces scientific and mathematical principles applicable in the installation, operation, and maintenance of HVAC systems. Types of units, parts, basic controls, functions, and applications will be covered. Additional topics include tool and meter use, temperature measurement, heat flow, the combustion process, and pipe installation practices. This course also emphasizes health, safety, and welfare standards and codes as mandated by professional and governmental agencies.

- DOE Code: 5496
- Recommended Grade Level: Grade 11-12
- Recommended Prerequisites: Introduction to Construction
- Credits: 2-3 credits per semester, maximum of 6 credits
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- This course is aligned with postsecondary courses for Dual Credit:
 - Ivy Tech
 - CONT 101 – Introduction to Construction
 - HVAC 101 – Heating Fundamentals
 - HVAC 103 - Refrigeration

Dual Credit

This course provides the opportunity for dual credit for students who meet postsecondary requirements for earning dual credit and successfully complete the dual credit requirements of this course.

Application of Content and Multiple Hour Offerings

Intensive laboratory applications are a component of this course and may be either school based or work based or a combination of the two. Work-based learning experiences should be in a closely related industry setting. Instructors shall have a standards-based training plan for students participating in work-based learning experiences. When a course is offered for multiple hours per semester, the amount of laboratory application or work-based learning needs to be increased proportionally.

Career and Technical Student Organizations (CTSOs)

Career and Technical Student Organizations are considered a powerful instructional tool when integrated into Career and Technical Education programs. They enhance the knowledge and skills students learn in a course by allowing a student to participate in a unique program of career and leadership development. Students should be encouraged to participate in SkillsUSA, the CTSO for this area.

Content Standards

Domain – Safety

Core Standard 1 Students integrate shop and workplace safety concepts into projects to ensure compliance with professional and governmental regulations.

Standards

- HVACI-1.1 Demonstrate safe practices and procedures with power and hand tools
- HVACI-1.2 Explain the characteristics of pressurized cylinders and gases used in brazing, soldering,

- leak testing, and refrigeration systems
- HVACI-1.3 Discuss the characteristics and concerns of heating fuels
- HVACI-1.4 Demonstrate an understanding of basic shop and workplace safety in compliance with OSHA standards
- HVACI-1.5 Demonstrate basic first aid procedures
- HVACI-1.6 Interpret health, safety, and welfare standards as dictated by local, state, or federal agencies

Domain – Piping

Core Standard 2 Students apply and adapt the appropriate techniques to design and layout various piping systems.

Standards

- HVACI 2.1 Demonstrate refrigeration and gas piping connections including flaring, swaging, soldering, brazing, and NPT threading
- HVACI-2.2 Design and layout natural gas and propane piping schematics for use with rigid and flexible fuel delivery systems

Domain – Electricity

Core Standard 3 Students analyze principles of electricity to repair, maintain, and troubleshoot HVAC systems.

Standards

- HVACI-3.1 Understand the principles and applications of voltage, amperage, resistance, and power
- HVACI-3.2 Identify the applications of transformers and low voltage circuits
- HVACI-3.3 Explain the concepts of low voltage switches, relays, thermostatic and pressure controls
- HVACI-3.4 Identify common electrical schematic symbols used in furnace and refrigeration electrical diagrams

Domain – Heating Fundamentals

Core Standard 4 Students evaluate various fuels to service heating appliances.

Standards

- HVACI-4.1 Demonstrate the use of the tools, test equipment and materials used in heating equipment installation and service
- HVACI-4.2 Explain the combustion and heating process of a fossil fuel furnace
- HVACI-4.3 Explain the operation of safety devices and components
- HVACI-4.4 Describe the sequence of operation for all levels of furnace efficiencies
- HVACI-4.5 Measure temperature rise across heat exchangers and calculate system airflow
- HVACI-4.6 Identify various ignition systems and flame proving devices
- HVACI-4.7 Explain and measure fuel pressure readings and scales
- HVACI-4.8 Troubleshoot furnace malfunctions
- HVACI-4.9 Measure and perform start-up procedures for new heating equipment

Domain – Refrigeration Fundamentals

Core Standard 5 Students analyze refrigeration principles to repair, install, and troubleshoot air conditioning systems.

Standards

- HVACI-5.1 Demonstrate the use of the tools, test equipment and materials used in refrigeration

- equipment installation and service
- HVACI-5.2 Define and understand pressure and vacuum scales and measurement
 - HVACI-5.3 Define key terms and components associated with refrigeration systems
 - HVACI-5.4 Explain the basic principles of heat transfer
 - HVACI-5.5 Identify refrigerant pressure and temperature relationship
 - HVACI-5.6 Identify refrigerant states throughout a refrigeration system such as superheated, subcooled, and saturated conditions
 - HVACI-5.7 Analyze refrigeration systems based on superheat, subcooling, compressor amps, evaporator temperature drop, and loads
 - HVACI-5.8 Explain the basics of ozone depletion and refrigerant conservation as outlined by Section 608 of the Clean Air Act

Process Standards

Common Core Literacy Standards for Technical Subjects

Reading Standards for Literacy in Technical Subjects 11-12

The standards below begin at grade 11 and define what students should understand and be able to do by the end of grade 12. The CCR anchor standards and high school standards in literacy work in tandem to define college and career readiness expectations – the former providing broad standards, the latter providing additional specificity.

Key Ideas and Details

- 11-12.RT.1 Cite specific textual evidence to support analysis of technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
- 11-12.RT.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
- 11-12.RT.3 Follow precisely a complex multistep procedure when performing technical tasks; analyze the specific results based on explanations in the text.

Craft and Structure

- 11-12.RT.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific context relevant to *grades 11-12 texts and topics*.
- 11-12.RT.5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
- 11-12.RT.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

Integration of Knowledge and Idea

- 11-12.RT.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
- 11-12.RT.8 Evaluate the hypotheses, data, analysis, and conclusions in a technical subject, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

- 11-12.RT.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Range of Reading and Level of Text Complexity

- 11-12.RT.10 By the end of grade 12, read and comprehend technical texts in the grades 11-CCR text complexity band independently and proficiently.

Writing Standards for Literacy in Technical Subjects 11-12

The standards below begin at grade 11 and define what students should understand and be able to do by the end of grade 12. The CCR anchor standards and high school standards in literacy work in tandem to define college and career readiness expectations – the former providing broad standards, the latter providing additional specificity.

Text Types and Purposes

- 11-12.WT.1 Write arguments focused on *discipline-specific content*.
- 11-12.WT.2 Write informative/explanatory texts, including technical processes.
- 11-12.WT.3 Students will not write narratives in technical subjects. *Note: Students' narrative skills continue to grow in these grades. The Standards require that students be able to incorporate narrative elements effectively into arguments and informative/explanatory texts. In technical, students must be able to write precise enough descriptions of the step-by-step procedures they use in their technical work that others can replicate them and (possibly) reach the same results.*

Production and Distribution of Writing

- 11-12.WT.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- 11-12.WT.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
- 11-12.WT.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Research to Build and Present Knowledge

- 11-12.WT.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
- 11-12.WT.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation
- 11-12.WT.9 Draw evidence from informational texts to support analysis, reflection, and research.

Range of Writing

- 11-12.WT.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.